

American Electric Power Energy Storage

**Presentation to:
IEEE / DOE / EAC
Energy Storage
June 17, 2014**

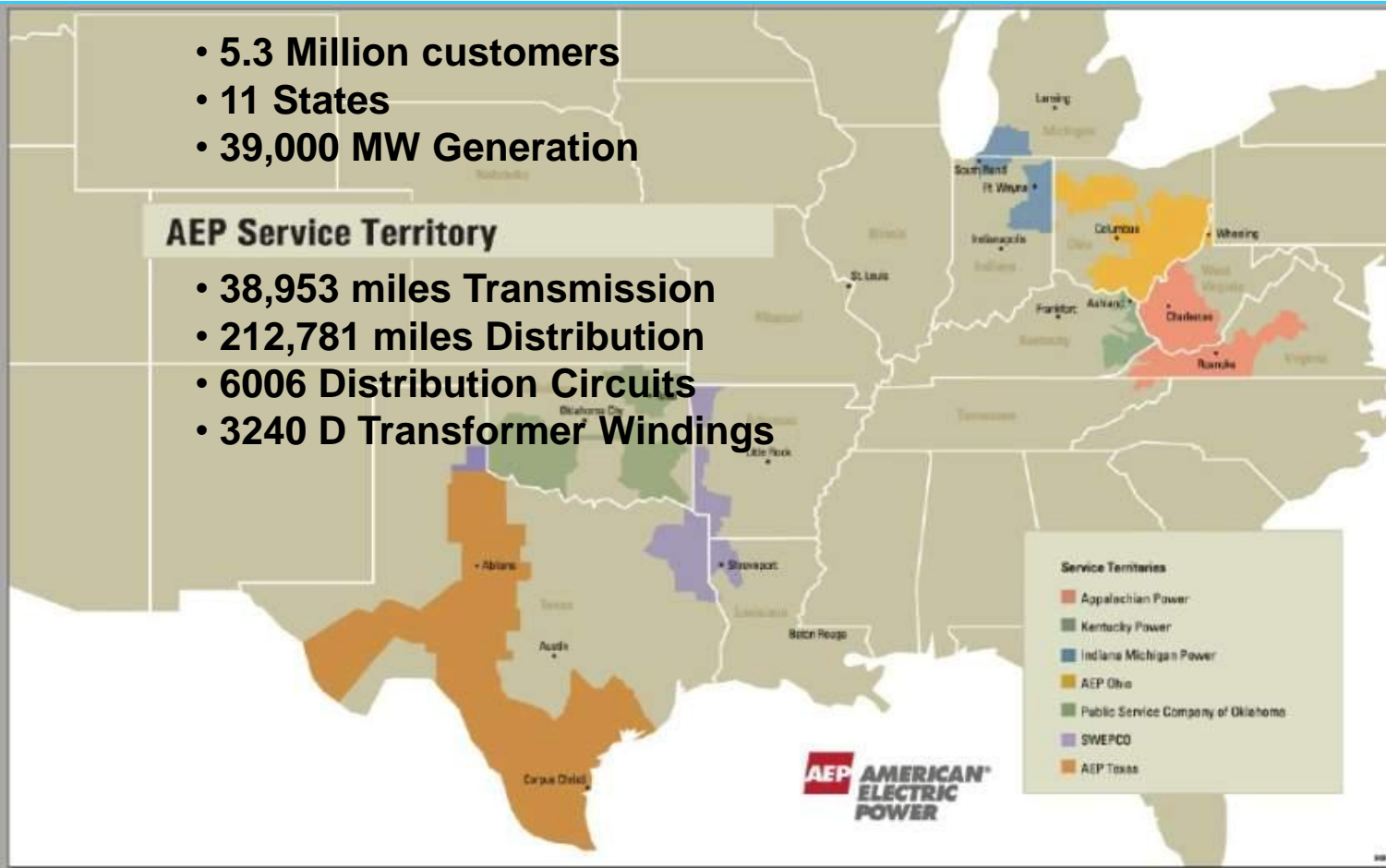
By: Thomas F. Weaver, PE
Manager, Distribution System Planning

AEP System Overview

- 5.3 Million customers
- 11 States
- 39,000 MW Generation

AEP Service Territory

- 38,953 miles Transmission
- 212,781 miles Distribution
- 6006 Distribution Circuits
- 3240 D Transformer Windings



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Energy Storage At AEP

- The Next Step -



AEP's (NaS) Battery Application

1 MW, 7.2 MWh installed in Chemical Station
(Charleston, WV - 2006)

- Deferred substation upgrades

Three installations in 2008 (2 MW Each)

- Peak Shaving
- Demonstrate “Islanding”
- Storage of intermittent renewables
- Sub-transmission support

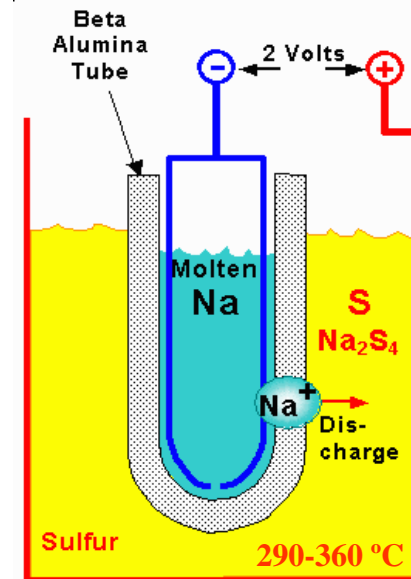


AEP selected Sodium Sulfur (NaS) technology

- Proven technology in Japan (TEPCO)
- 1-10 MW, 4-8 hour storage systems
- NaS strengths:
 - *Commercial record over 1MW (over 100 installations)*
 - *Cost*
 - *Compactness*
 - *Modularity & Ability to be relocated*

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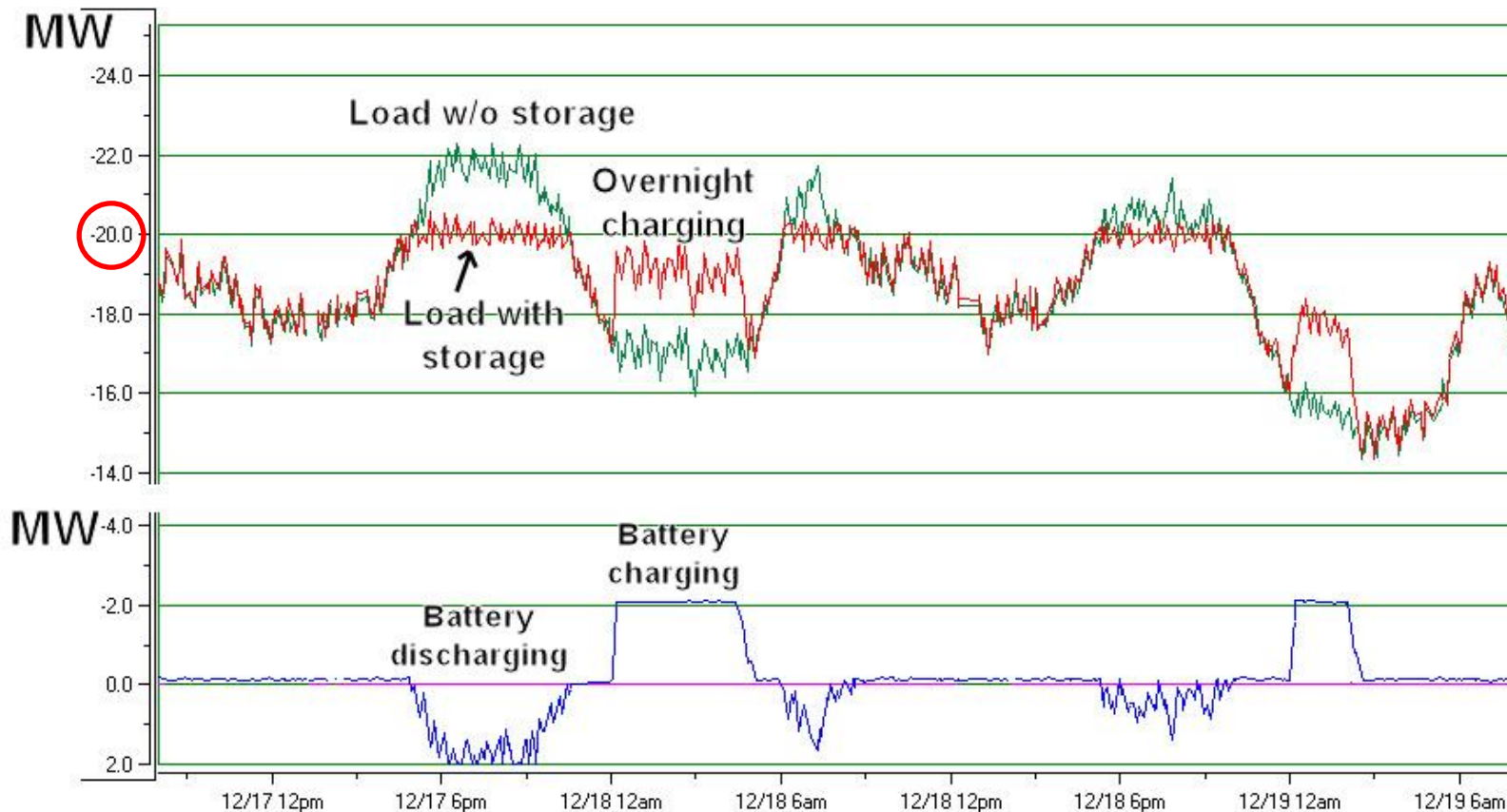
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Bluffton, OH – 2 MW with Islanding



Load Leveling Example

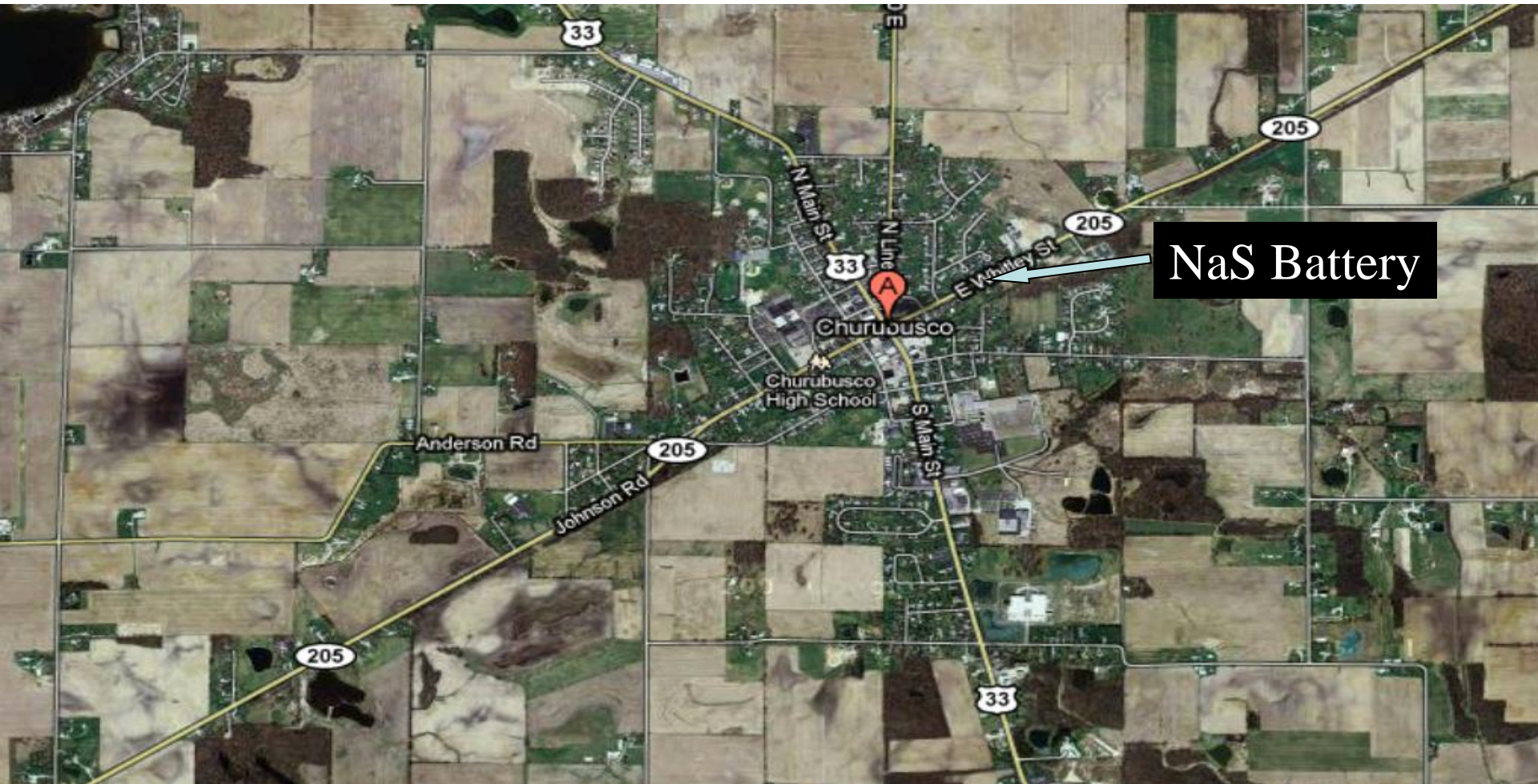


Performance of Balls Gap's 2MW Battery from 12/17 to 12/19/2008

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Churubusco, IN with Islanding



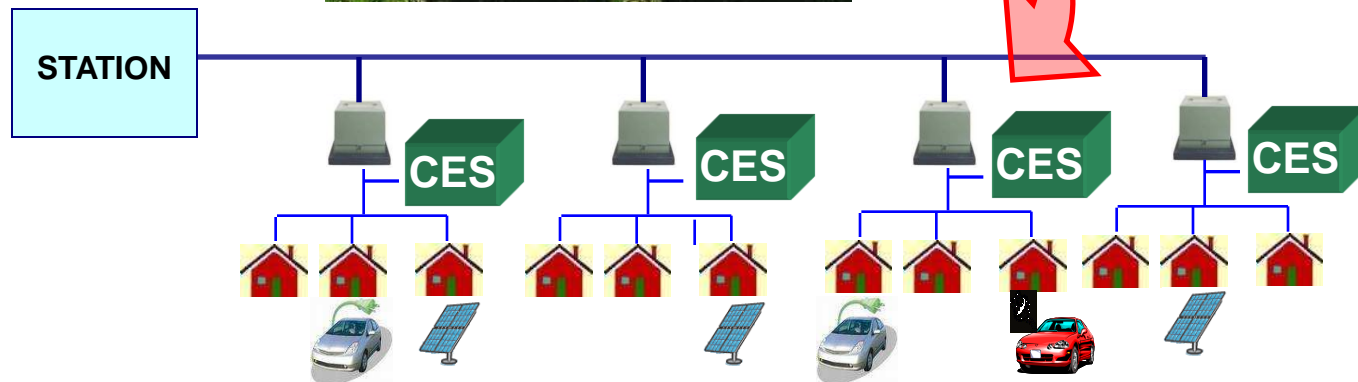
The Concept of Community Energy Storage

- **CES** uses distributed resources to offer >> flexibility @ << cost than **bulk** storage as battery volumes increase
- CES fits with the Grid's emerging need for **Distributed Intelligence AND Speed**
- Storage at the load offers unique benefits that bulk storage can't match
 - Direct integration with PHEV batteries to act as a buffer for load mgmt (PHEV charging)
 - Direct integration with customer owned renewable resources
 - Demand Control thru contractual integration with HAN



Community Energy Storage (CES)

CES is a distributed fleet of small energy storage units connected to the secondary of transformers serving a few houses or small commercial loads.



CES Specifications

Key Parameters	Value
Power (active and reactive)	25 kVA / 25 kW
Energy	25 kWh future 75 kWh
Voltage	240 / 120V AC
Battery – Similar to PHEV	Li-Ion
Round trip efficiency	> 85%



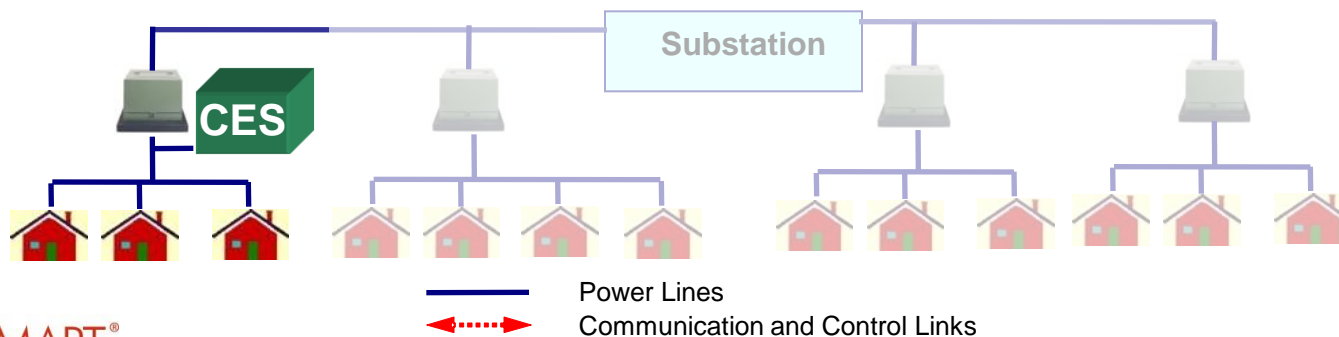
AEP Specifications for CES are “OPEN SOURCE” for Public Use and Feedback.
During 2009 EPRI hosted free, open webcasts to solicit industry wide input.

www.aeptechcenter.com/ces

CES – Virtual Station Scale Storage

Local Benefits:

- 1) Backup power**
- 2) Flicker Mitigation**
- 3) Renewable Integration**



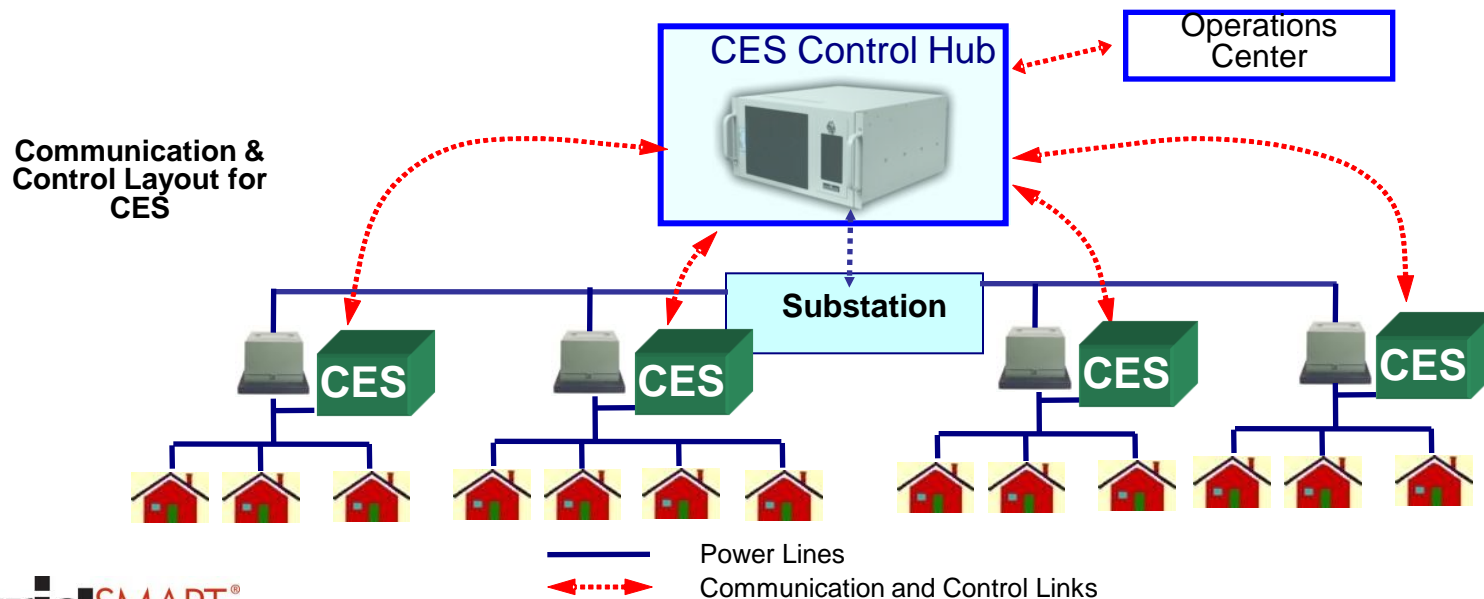
CES – Virtual Station Scale Storage

Local Benefits:

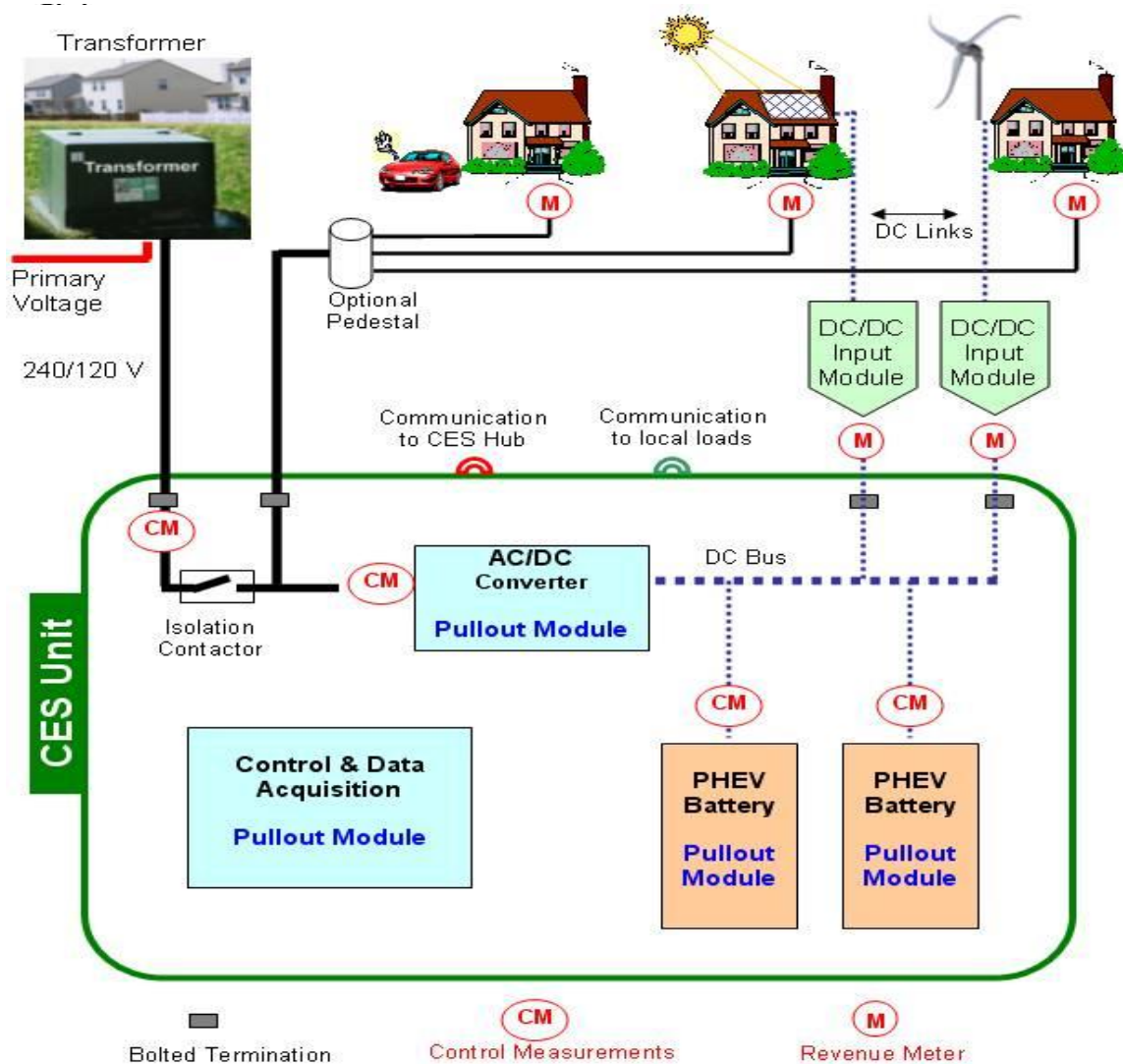
- 1) Backup power
- 2) Flicker Mitigation
- 3) Renewable Integration

Grid Benefits:

- 4) Load Leveling at substation
- 5) Power Factor Correction
- 6) Ancillary services



CES Layout



Drivers for Energy Storage

- Peak Load Shaving / Leveling
 - T&D infrastructure project deferrals
 - Increased utilization of existing Generation
- Islanding of Load Area
- Smoothing Variability of Solar / Wind Generation
- Energy Arbitrage
 - Charge at lower cost / Discharge at higher value
- Ancillary Services
 - Frequency regulation
 - Spinning reserve

Balancing Cost and Benefits

- Energy Storage Cost is still high
- Energy density needs to improve
- Utilities need to find full value of energy storage
 - T&D deferral is easiest to calculate but varies greatly
 - Other values such as energy arbitrage, frequency, enhancement of variable energy sources, etc. do not have identified \$\$ values

DOE Project Enhancements



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Questions?

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